FISHERIES CONSERVATION AND STEWARDSHIP EFFORTS



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EXECUTIVE SUMMARY

The Santa Clara Valley Water District's (District) mission statement and policies from the Board of Directors (Board) promote fisheries conservation and stewardship. Healthy and thriving native fish populations are an integral part of the District's environmental, economic, stewardship and management goals for the County's rivers, creeks, sloughs, and reservoirs. Santa Clara County's waterways are currently home to a variety of fish, including both native and nonnative species.

The purpose of this document is to provide a summary of the District's policies and efforts to support and maintain healthy and thriving native fish populations. While it is recognized that much work has been done, there is still work to do with multiple factors that must be improved to better support native fish in Santa Clara County. The planning for these factors will be undertaken as part of the Integrated Water Resources Master Plan.

This document summarizes a variety of topics regarding fisheries in the County including historic and current fish species assemblage, anthropogenic factors which impact native fisheries, potential fish passage improvement projects, and a list of fisheries enhancements conducted by the District and others. This report emphasizes freshwater and anadromous fish species with limited information on estuarine fish species. The District is moving toward a comprehensive and watershed management based approach to preserve, rehabilitate, and enhance Santa Clara County's native fisheries. This is evident in the District's integral role in projects and programs that support or enhance native fish populations, including:

- Fisheries and habitat enhancement projects funded by the voter-approved Safe, Clean Water and Natural Flood Protection Program;
- Fisheries and Aquatic Habitat Collaborative Effort (FAHCE);
- Guadalupe River mitigation monitoring and adaptive management program;
- Integrated Water Resources Master Plan;
- Climate change planning; and
- District Asset Management Program.

The District's mission, Board policies, and Chief Executive Officer outcome measures and strategies provide overarching direction to manage for healthy habitats, including and especially fisheries habitats in Santa Clara County. This document summarizes the District's fisheries conservation, mitigation, and stewardship efforts.

I. INTRODUCTION

The Santa Clara Valley Water District (District) provides Silicon Valley safe, clean water for a healthy life, environment, and economy. The District manages an integrated water resources system that includes the supply of clean, safe water, flood protection, and stewardship of streams on behalf of Santa Clara County's 1.8 million residents. The District effectively manages 10 dams and surface water reservoirs, three water treatment plants, an advanced recycled water purification center, a state-of-the-art water quality laboratory, nearly 400 acres of groundwater recharge ponds, and more than 275 miles of streams. Healthy and thriving native fish populations are an integral part of the District's environmental, economic, stewardship and management goals for the County's rivers, creeks, sloughs and reservoirs.

This is not intended to be a research paper or a detailed project plan, but rather a broad brush document to inform the District Board of Directors and the public of the various efforts by the District to preserve and improve native fisheries in Santa Clara County. This document identifies District policies and applicable laws and regulations which promote fisheries management in the County. A summary of completed, current and planned programs the District has undertaken to fulfill those commitments and benefit native fisheries is presented. A brief history of fisheries in the County and discussion of anthropogenic changes which have impacted native fisheries over time is also included.

The District-initiated Integrated Water Resources Master Plan (Master Plan) is being developed as a long term plan for management of Santa Clara County water resources based on scientific rigor, integrated watershed-scale considerations, and stakeholder engagement. The Master Plan will integrate the three components of the District mission including water supply, flood protection, and watershed stewardship. In so doing, the Master Plan will focus on various planning elements including water supply, flood protection, water quality, open space, trails and recreation, climate change, bayfront areas, ecological elements including wildlife, vegetation, fisheries, and their habitats. For the majority of these elements, information will be drawn from existing or new planning studies, reports, assessments, and other data collection efforts.

The Master Plan will build upon this framework to provide more detailed management objectives specific to each of the District's watersheds (Coyote, Guadalupe, West Valley, Lower Peninsula, and Uvas/Llagas). These watershed specific plans will compile information to evaluate, prioritize, and integrate activities and enhancements to improve conditions for native fisheries. The watershed specific plans are anticipated to identify habitat enhancements including in-stream habitat complexity, gravel augmentation, barrier remediation, geomorphologic changes, riparian restoration, improved water quality, and pollution prevention. Some of these enhancements are described in the District's voter approved Safe, Clean Water and Natural Flood Protection Program. Past habitat conditions in Santa Clara County watersheds are uniquely described in District funded historical ecology publications by the San Francisco Estuary Institute (SFEI), which include recommendations for restoration and other actions.

II. SANTA CLARA VALLEY WATER DISTRICT BOARD OF DIRECTORS POLICIES

The District's mission, Governance and Ends Policies, Board Appointed Officers' interpretations, and Chief Executive Officer (CEO) strategies promote fisheries conservation and stewardship. Additionally, resource agency permits, agreements and requirements drive District actions related to fisheries.

The Board Ends Policy E-2 states "there is a reliable, clean water supply for current and future generations." This policy has ancillary benefits associated with fisheries since surface water availability is essential to a healthy fishery. Goal 2.1 is current and future water supply for municipalities, industries, agriculture, and the environment is reliable. This goal is further defined in Objective 2.1.2 and the associated CEO interpretations including: 2.1.2.2 manage, operate and maintain dams and reservoir assets to maximize reliability, minimize life cycle costs, and minimize impacts to the environment; 2.1.2.4 work with the wildlife agencies to address the impact of District water supply operations on fish; and 2.1.2.5 secure water rights through FAHCE.

Board Ends Policy E-3 states there is a healthy and safe environment for residents, businesses and visitors, as well as for future generations. This policy further elaborates upon its role in conservation and stewardship of fisheries in Objective 3.1.2, Strategy S 3.2, and Outcome Measure 3.1.1.l. These sections combine flood protection with natural ecological function and conditions within the watersheds.

The Board Ends Policy that is directly related to conservation and stewardship of fisheries is Policy E-4. This policy states there is water resources stewardship to protect and enhance watersheds and natural resources, and to improve the quality of life in Santa Clara County. This policy is further defined through Goal 4.1 to protect and restore creek, bay, and other aquatic ecosystems. In addition, Objectives 4.1.1, 4.1.2, 4.1.3, 4.1.4, and 4.1.6 strive to preserve, improve, promote further protection of and educate the community about aquatic ecosystems, threats of pollution and stream stewardship. Objective 4.1.6 directly references fisheries by stating, to the extent within practicable control of the District, adopt a strategy to restore the salmonid fishery on identified salmonid streams within fifteen years of strategy adoption by creating suitable accessible spawning and rearing habitats. Table 1 shows the relationship of Board Policies to the various CEO interpretations and strategies which relate to fisheries and habitat.

These policies and direction from the Board as well as mandates from state and federal resource agencies have led to a variety of projects that contribute to conservation and stewardship of local fisheries resources and habitats. The District developed the Safe, Clean Water and Natural Flood Protection Program, Integrated Water Resources Master Plan, Fisheries and Aquatic Habitat Collaborative Effort (FAHCE), and other mitigation monitoring programs which have led to a better understanding of fisheries within the County.

TABLE: 1 District Board Policy E-2, E-3, E-4, and CEO Interpretations Related to Fisheries and Habitat

District Board Governance Policies			CEO Interpretation	
Ends	**Goal**	**Objective**	**Outcome Measures**	**Strategies**
E-2 There is a reliable, clean water supply for current and future generations	2.1 Current and future water supply for municipalities, industries, agriculture, and the environment is reliable.	2.1.2 Protect, maintain, and develop local surface water		S 2.1.2.2
				S 2.1.2.4
				S 2.1.2.5
E-3 There is a healthy and safe environment for residents, businesses and visitors, as well as for future generations	3.1 Provide natural flood protection for residents, businesses, and visitors.	3.1.2 Preserve flood conveyance capacity and structural integrity of stream banks, while minimizing impacts on the environment and protecting habitat values.	3.1.1.l	S.3.2
E-4 There is water resources stewardship to protect and enhance watersheds and natural resources and to improve the quality of life in Santa Clara County.	4.1 Protect and restore creek, bay, and other aquatic ecosystems.	4.1.1 Preserve creeks, bay, and ecosystems through environmental stewardship.	4.1.1.a	S.4.1.1.1
			4.1.1.b	S.4.1.1.2
			4.1.1.c	S.4.1.1.3
			4.1.1.d	S.4.1.1.4
			4.1.1.f	S.4.1.1.5
			4.1.1.g	S.4.1.1.6
			4.1.1.h	S.4.1.1.7
			4.1.1.i	S.4.1.1.12
			4.1.1.j	S.4.1.1.14
			4.1.1.k	S.4.1.1.16
			4.1.1.l	
			4.1.1.m	
		4.1.2 Improve watersheds, streams, and natural resources.	4.1.2.c	S.4.1.2.3
			4.1.2.g	S.4.1.2.4
			4.1.2.h	S.4.1.2.5
			4.1.2.i	S.4.1.2.6
			4.1.2.j	S.4.1.2.7
			4.1.2.k	S.4.1.2.10
				S.4.1.2.10a
				S.4.1.2.10b
				S.4.1.2.11
				S.4.1.2.12
		4.1.3 Promote the protection of creeks, bay, and other aquatic ecosystems from threats of pollution and degradation.	4.1.3.a	S 4.1.3.1
			4.1.3.b	S 4.1.3.2
			4.1.3.c	S 4.1.3.3
			4.1.3.d	S 4.1.3.4
				S 4.1.3.8

District Board Governance Policies			CEO Interpretation	
Ends	**Goal**	**Objective**	**Outcome Measures**	**Strategies**
		4.1.4 Engage and educate the community in the protection of water quality and stream stewardship.	4.1.4.b	S 4.1.4.1
			4.1.4.c	S 4.1.4.2
				S 4.1.4.3
				S 4.1.4.4
		4.1.6 To the extent within practicable control of the District, adopt a strategy to restore the salmonid fishery on identified salmonid streams within fifteen years of strategy adoption by creating suitable accessible spawning and rearing habitats.		

III. LAWS, REGULATIONS, PLANS, AND POLICIES PROTECTING FISH

There are a variety of Federal, State, and local laws, regulations, orders, plans, policies, and agreements to protect fisheries and fish habitat in Santa Clara County (Table 2). Regulatory obligations require that projects avoid, minimize, and mitigate unavoidable impacts to fish and their habitat. Typically, these regulations drive project specific fixes for fisheries or habitat impacts rather than program level or watershed-wide changes. Historically, laws and regulations are applied on a project-by-project basis instead of on a programmatic level.

The current direction of Federal and State aquatic habitat and fisheries regulation is watershed based management. While this was discussed for decades, it is occurring now with implementation of habitat conservation plans (HCPs), natural community conservation plans (NCCPs), rare species recovery plans, mitigation banking, Compensatory Mitigation for Losses of Aquatic Resources: Final Rule (United States Army Corps of Engineers (USACE) and United States Environmental Protection Agency (EPA) 2008), State Water Resources Control Board's Watershed Management Initiative, and draft Wetland and Riparian Area Protection Policy. The District has been directly involved in some of these efforts, such as the Santa Clara Valley Habitat Plan as co-permittee (an HCP and NCCP) and the Surface Water Ambient Monitoring Program (SWAMP) with the State Water Resources Control Board. Mitigation for the District's Stream Maintenance Program (SMP) environmental effects requires preserving large areas of land and focusing on watershed, stream and rare species protection. The District's Master Planning efforts in conjunction with Board policies and the various laws and regulations should help to effect positive change on a more programmatic level regarding watershed and environmental management.

TABLE 2: Federal, State, and Local Laws, Regulations, and Plans Applicable to Fisheries and Aquatic Habitats

Jurisdiction	Law/ Regulation *	Agencies with Jurisdiction
Federal	Federal Endangered Species Act (FESA)	U. S. Fish and Wildlife Service & National Marine Fisheries Service
	Sustainable Fisheries Act (amended Magnuson-Stevens Fishery Conservation and Management Act)	National Marine Fisheries Service
	Clean Water Act also known as the Federal Water Pollution Control Act	U. S. Army Corps of Engineers & U. S. Environmental Protection Agency
	Fish and Wildlife Coordination Act	U. S. Fish and Wildlife Service
	National Environmental Policy Act (NEPA)	Council on Environmental Quality
	Executive Order 12962 for Recreational Fisheries	All Federal agencies
State	California Environmental Quality Act (CEQA)	All State agencies
	California Endangered Species Act (CESA)	California Department of Fish and Wildlife
	California Fish and Game Code	California Department of Fish and Wildlife, Fish and Game Commission
	Clean Water Act (Section 401), Porter-Cologne Water Quality Control Act, and supporting Water Quality Control Plan for the San Francisco Bay Basin and Water Quality Control Plan for the Central Coastal Basin (Basin Plans)	San Francisco Bay Regional Water Quality Control Board & Central Coast Regional Water Quality Control Board
	California Water Code	State Water Resources Control Board & Regional Water Quality Control Boards
	California Code of Regulations	State Water Quality Control Board & Regional Water Quality Control Boards
	California Water Plan	California Department of Water Resources & California Department of Fish and Wildlife
Regional	Coastal Zone Management Act and McAteer-Petris Act	San Francisco Bay Conservation and Development Commission

*There may be other laws, regulations, plans, policies, and agreements not named here that may apply to specific District projects, programs, or activities (e.g., memorandum of understanding (MOU), water rights, water use and other agreements).

IV. FISHERIES IN SANTA CLARA COUNTY

4.1 HISTORIC FISH ASSEMBLAGES

Due to the diverse landscapes and geological complexities, accompanied with the semi-arid climate of California, the diversity of endemic fish is limited to 66 freshwater, estuarine, and anadromous fish (not including subspecies) (Moyle 2002). Moyle (2002) divided California into six ichthyological (the study of fishes) provinces. The province covering Santa Clara Valley is large and known as the Sacramento-San Joaquin Province. Within this province, 40 endemic species of fish are present. The District subdivides Santa Clara County into five watersheds or zones: Lower Peninsula, West Valley, Guadalupe, Coyote, and Uvas/Llagas. These designations do not always follow the definition of a watershed, but serve as a distinguishable boundary for District operations. The Lower Peninsula, West Valley, Guadalupe, and Coyote watersheds drain into San Francisco Bay, while Uvas/Llagas watershed drains into the Pajaro River, which enters Monterey Bay. James Snyder, Assistant Professor of Zoology at Stanford University, was one of the first to record fish assemblages present in Santa Clara County, and serves as a baseline for fisheries assemblages (Snyder, 1904 and 1913).

Although other references and early explorer accounts provide some potentially differing perspectives of the fish occurring locally, early-1900's research and subsequent scientific accounts were used to develop the fish assemblage list that could be considered endemic to the Santa Clara County streams. Taxonomic changes over the years have led to some confusion of the species, but the latest taxon assignments have been applied to the historic accounts presented here. Other research in the late 1900's was conducted, but anthropogenic changes could have led to the occurrence of species that may not have been endemic to the county. In 1904, Snyder documented thirteen species of fish in eight Santa Clara County tributaries of San Francisco Bay. A creek from each District watershed flowing to San Francisco Bay, except for West Valley, was represented in his samples. In 1909, Snyder continued his research in the Uvas/Llagas watershed (including the Parajo River) and documented 13 different species, with 7 specifically found in Uvas and Llagas Creeks (Table 3). During these initial collections, Snyder did not record the presence of Sacramento perch (*Archoplites interruptus*) or western brook lamprey (*Lampetra richardsoni*) within Santa Clara County. A researcher for the University of Michigan, Carl L. Hubbs, documented the presence of both of these species during his study in Coyote Creek in May of 1922, while researching the life cycle of lampreys (Hubbs, 1925). W. Follett with the California Academy of Sciences also found Sacramento perch in the watershed in 1932. Riffle sculpin (*Cottus gulosus*) were not recorded in Coyote Creek until 1953 by Terrence J. Merkel of the University of California Berkley. However, it is possible they were incorrectly identified by earlier collectors owing to the high variability in morphological features of the Cottidae family (Aceituno et al., 1976). From the culmination of research, it has been determined that 16 different species are endemic to Santa Clara County watersheds that drain to San Francisco Bay (Table 4). Other species were potentially present but may not have been captured using early sampling techniques. Tables 3 and 4 provide lists of endemic species based on pre-1953 scientific sampling efforts.

TABLE 3: Historically Endemic Fish to Santa Clara County Streams (Uvas and Llagas Creeks) That Drain to Monterey Bay*, Compiled From Snyder (1913)

Common Name	Scientific Name
Riffle Sculpin	*Cottus gulosus*
Rainbow Trout	*Oncorhynchus mykiss*
Sacramento Sucker	*Catostomus occidentalis*
Hitch	*Lavinia exilicauda*
California Roach	*Lavinia symmetricus*
Speckled Dace	*Rhinichthys osculus*
Sacramento Pikeminnow	*Ptychocheilus grandis*
Riffle Sculpin	*Cottus gulosus*
Scientific names have been change to match modern nomenclature.	

*Note that all of these species were also found in Santa Clara County Rivers and creeks flowing to San Francisco Bay.

TABLE 4: Historically Endemic Fish to Santa Clara County Streams That Drain to San Francisco Bay Complied From Snyder (1904), Hubbs (1925), Aceituno et al. (1976), and Moyle (2002)

Common Name	Scientific Name
Pacific Lamprey	*Lampetra tridentate*
Western Brook Lamprey	*Lampetra richardsoni*
Rainbow Trout	*Oncorhynchus mykiss*
Sacramento Sucker	*Catostomus occidentalis*
Sacramento Blackfish	*Orthodon microlepidotus*
Hitch	*Lavinia exilicauda*
Sacramento Splittail	*Pogonichthys macrolepidotus*
Sacramento Pikeminnow	*Ptychocheilus grandis*
Thicktailed Chub	*Gila crassicauda*
California Roach	*Lavinia symmetricus*
Speckled Dace	*Rhinichthys osculus*
Three-Spined Stickleback	*Gasterosteus aculeatus*
Tule Perch	*Hysterocarpus traski*
Sacramento Perch	*Archoplites interruptus*
Prickly Sculpin	*Cottus asper*
Riffle Sculpin	*Cottus gulosus*
Scientific names have been change to match modern nomenclature.	

Based on historical fisheries research, it has been determined that at least 16 different species are endemic to stream systems within Santa Clara County (excluding estuarine fishes). Other anadromous species such as Chinook Salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), pink salmon (*Oncorhynchus gorbushcha*), and Eulachon (Thaleichthys

pacificus) have been observed in Santa Clara County in the last 20 years, and are native to California and the Sacramento-San Joaquin Province, but historical data suggest they are not endemic to Santa Clara County watersheds, and only occur on a transient basis. Specific genetic testing of over 450 Chinook salmon captured in Santa Clara Valley indicate that the fish are closely related to Central Valley Fall Run Chinook salmon and the presence of fin clipped hatchery fish with coded wire tags indicates a strong probability of straying (Garcia-Rossi, 2002). Pacific staghorn sculpin (*Leptocottus armatus*) are native to California and are most likely endemic to the lower reaches of Santa Clara County streams but were not accounted for in early assemblage monitoring.

4.2 CURRENT FISH ASSEMBLAGES

Changes to the species assemblage of fish in Santa Clara County have occurred since Snyder's original surveys. Modifications to the watershed coincided with the local extirpation and extinction of endemic fauna, and the introduction of non-endemic species (Aceituno et al., 1976 and Habitat Restoration Group (HRG), 1995). Thicktailed chub and Sacramento splittail were first and last reported in Coyote Creek by Snyder (1904). Thicktailed chub are extinct with the last recorded specimen being caught in the Sacramento River near Rio Vista in 1957 (Moyle, 2002). It is possible that Sacramento splittail were already declining when Snyder recorded their presence in 1904. The last recorded occurrence for Sacramento perch in Coyote Creek was 1959. Tule perch and western brook lamprey were first recorded in the Coyote basin by Hubbs (1925) in 1922. A single tule perch was found on the main stem of Coyote Creek in 1999 (Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), 2001). The District confirmed different year classes of tule perch in the Ogier Ponds on Coyote Creek in June 2003. They have also been found in the Guadalupe River and Calero Reservoir, subsequently. Tule perch may have been locally extirpated after 1922 and reintroduced back to Coyote Creek during pipeline water transfers from the Central Valley. Alternatively, it is also possible that the numbers were so depressed in years subsequent to the first observation that other researchers did not observe the fish. The last recorded observation of speckled dace in Coyote Creek occurred in 1977, during the height of a severe drought (HRG, 1995). Moyle (2002) reports that speckled dace have limited distributions in some watersheds, which can make them prone to local extirpation. Limited recent data is available for speckled dace populations in the Uvas/Llagas watershed, but fish were present in 1974 during surveys conducted by Smith (1982). Snyder (1904) postulated that local extinctions followed by re-colonization from adjacent watersheds could be a significant ecological factor for fishes in South Bay streams. Without those connections, extirpations may be more protracted or permanent.

The introduction, naturalization, and straying of fish species into the Santa Clara Valley has led to an increase in species richness, however this may be to the detriment of native fish populations. The development of reservoirs, impoundments, and diversions has increased available habitat for non-native warm water species, and imported water has been a vector for introduction of species from outside the watershed. Other potential vectors of introduction include sport fish management, sport fishing, biological controls, aquaculture, and pets (Moyle, 2002).

The District's biological staff has observed the presence of 33 non-endemic fish in the watersheds during field surveys and a reduction of endemic species from a total of 16 to 13–species (Table 5). The presence of non-endemic species is only an estimate as new species have the potential of being discovered or introduced at any time. Endemic and non-endemic estuarine fish are present within the brackish and estuary areas of Santa Clara County. Many

estuarine and marine fish found in San Francisco Bay were not included in the list as they are transient and often not seen in areas managed by the District. The list provided gives insight to the current fish assemblages based upon observation, but yearly and seasonal changes can contribute to variations within the assemblage. All, some, as well as, other fish can be present within Santa Clara County at any given time.

TABLE 5: Fish Assemblage of All Watersheds Within Santa Clara County Based Upon Data Collected by District Biological Staff and Cited in Other Literature

Common Name	Scientific Name	Endemic	Protection Status
Pacific Lamprey	*Entosphenus tridentatus*	✓	-
White Sturgeon	*Acipenser transmontanus*		-
Threadfin Shad	*Dorosoma petenense*		-
American Shad	*Alosa sapidissima*		-
Fathead Minnow	*Pimephales promelas*		-
Hitch	*Lavinia excilicauda*	✓	-
California Roach	*Lavinia symmetricus*	✓	WL*
Speckled Dace	*Rhinichthys osculus*	✓	-
Sacramento Blackfish	*Orthodon microlepidotus*	✓	-
Splittail	*Pogonichthys macrolepidotus*	✓	-
Goldfish	*Carassius auratus*		-
Common Carp	*Cyprinus carpio*		-
Golden Shiner	*Notemigonus crysolecus*		-
Red Shiner	*Cyprinella lutrensis*		-
Sacramento Sucker	*Catostomus occidentalis*	✓	-
Black Bullhead	*Ameiurus melas*		-
Brown Bullhead	*Ameiurus nebulosus*		-
Yellow Bullhead	*Ameiurus natalis*		-
White Catfish	*Ameiurus catus*		-
Channel Catfish	*Ictalurus punctatus*		-
Wakasagi	*Hypomesus nipponensis*		-
Eulachon	*Thaleichthys pacificus*		-
Rainbow Trout**	*Oncorhynchus mykiss*	✓	TH(F)
Chinook Salmon	*Oncorhynchus tshawytscha*		-
Chum Salmon	*Oncorhynchus keta*		-
Pink Salmon	*Oncorhynchus gorbuscha*		-
Inland Silverside	*Menidia beryllina*		-
Rainwater Killifish	*Lucania parva*		-
Mosquito Fish	*Gambusia affinis*		-
Three-Spined Stickleback	*Gasterosteus aculeatus*	✓	-
Prickly Sculpin	*Cottus asper*	✓	-
Riffle Sculpin	*Cottus gulosus*	✓	-
Pacific Staghorn Sculpin	*Leptocottus armatus*		-
Largemouth Bass	*Micropterus salmoides*		-
Red-eye Bass	*Micropterus coosae*		-
Smallmouth Bass	*Micropterus dolomieu*		-
Striped Bass	*Morone saxatilis*		-
Green Sunfish	*Lepomis cyanellus*		-
Redear Sunfish	*Lepomis microlophus*		-
Pumpkinseed	*Leopmis gibbosus*		-
Bluegill	*Lepomis macrochirus*		-
White Crappie	*Pomoxis annularis*		-

Common Name	Scientific Name	Endemic	Protection Status
Black Crappie	*Poxomis nigromaculatus*		-
Sacramento Perch	*Archoplites interruptus*	✓	-
Tule Perch	*Hysterocarpus traski*	✓	-
Bigscale Logperch	*Percina macrolepida*		-
Yellowfin Goby	*Acanthogoius flavimanus*		-

WL: CDFW Watch List TH(F): Federally Threatened

* The subspecies of California Roach, *Lavinia symmetricus subditus* or Monterey Roach, is designated on CDFW Watch List due to habitat loss.

**Rainbow trout includes all *O. mykiss* DPS of steelhead (SCC and CCC)

4.3 SPECIAL STATUS FISH WITHIN SANTA CLARA COUNTY

Species may receive special regulatory consideration if it is thought that populations or a whole species are at particular risk of loss. There are several regulatory arenas in which this may occur. At the Federal level, the Endangered Species Act may be applied with a species listed as either Threatened or Endangered, the latter being more at risk of extinction. Additionally, for fishery resources, the Magnuson-Stevens Fishery Conservation and Management Act is a body of law intended to protect marine fish resources and their habitats. It was first developed in 1976 and most recently reauthorized in 2006. The ocean fish that run to freshwater to spawn may have the freshwater spawning and nursery habitat protections as well as consideration for free movement to and from those habitats. The Magnuson-Stevens Fishery Conservation Act uses the term “Essential Fish Habitat” to identify those areas necessary for the life-history expression of the species.

At the state level, the California Endangered Species Act may be applied to fish, wildlife or plants even when the Federal version has not been invoked. There are a variety of fish and wildlife statues, commonly known as the Fish and Game Code that may also apply to regulate the conditions under which fishery resources may be managed. These may include considerations for recreational and commercial fish management as well as more general public trust responsibilities including conservation and ecological functions.

RAINBOW TROUT/STEELHEAD (*ONCORHYNCHUS MYKISS*)

A steelhead is an anadromous (spawning and rearing in freshwater streams then maturing in the ocean) rainbow trout (*O. mykiss*). Steelhead were listed as threatened under the Federal Endangered Species Act in 1997. Any *O. mykiss* within watersheds designated as steelhead habitat is protected under the steelhead designation even if the fish has not experienced anadromy. Adult steelhead enter freshwater to spawn when winter rains have been sufficient to raise stream flows. Increased rain levels and the associated runoff provide migration cues and the water volume necessary for adult fish to navigate through stream obstructions that may be otherwise impassable (Moyle 2002). The season for upstream migration of Santa Clara County steelhead adults typically occurs between late December and April, allowing fish to take advantage of access to upper watersheds of seasonally flowing streams (Moyle et al. 2008).

O. mykiss select spawning sites, or redds, with gravel substrate and sufficient flow to maintain circulation through the gravel. In central California streams (including Santa Clara County), after hatching, steelhead typically rear for one to two years in freshwater streams. Downstream migration by juvenile steelhead is partially triggered by winter flood flow events. Young-of-the-year (less than a year old), one-year-old, and two-year-old fish likely participate in downstream migration, but it is typically the two-year-old fish that will smolt (i.e., experience the physiological process by which parr turn into smolts, the ocean-run life stage) and continue their migration to

oceanic feeding grounds. Downstream migration of one-year-old steelhead on Waddell Creek (Santa Cruz County) usually occurred from April through late June and two-year-old fish from March through late May (Shapovalov and Taft 1954) depending on sufficient flows. Fish within Santa Clara County follow similar patterns.

Since all *O. mykiss* (anadromous and resident) are the same species throughout California, a special designation has been given to individual geographically isolated populations. This designation is known as a Distinct Population Segment (DPS) and is the lowest taxonomic classification protected under the Endangered Species Act. The DPS within the Santa Clara Valley in tributaries that drain to San Francisco Bay is the Central California Coast steelhead (CCC steelhead). The DPS of steelhead within the Uvas/Llagas Watershed are South Central California Coast steelhead (SCCC steelhead).

CCC steelhead DPS (distinct population segment) includes coastal populations of winter steelhead from the Russian River south to Aptos Creek in Santa Cruz County, including the stream tributaries of the San Francisco Bay and San Pablo Bay basins. The CCC steelhead DPS was confirmed to be threatened in the 2006 status review. Critical habitat was designated for this DPS on January 5, 2006. The CCC steelhead populations in the Guadalupe River and Lower Peninsula watersheds are classified in the Coastal San Francisco Bay diversity stratum, while the Coyote Creek population is classified within the Interior San Francisco Bay diversity stratum (Williams et al., 2010). CCC Steelhead are not a California State listed species.

The SCCC steelhead found in the Uvas and Llagas systems range from the Pajaro River (including Uvas and Llagas creeks and associated tributaries) as far South as, but not including, the Santa Maria River in San Luis Obispo/Santa Barbara Counties. The Pajaro River drainage systems are considered interior population strata and owing to the more precarious population condition of the strata in that watershed and other watersheds within that DPS, are possibly considered more vulnerable to additional loss. The SCCC steelhead DPS was confirmed to be threatened in the 2006 Federal status review. SCCC Steelhead are not a California State listed species.

All steelhead receive additional Federal regulatory consideration under the Magnuson-Stevens Fishery Conservation and Management Act. The anadromous life-cycle of this species places the freshwater nursery habitat within the regulatory protections afforded by this set of Federal statutes. Typically the species/habitat is considered generally and the protections and management applied under the Federal Endangered Species Act are in alignment with the Essential Fish Habitat provisions.

All work activities and projects conducted by the District must consider the presence of steelhead populations and their habitats. Various seasonal time constraints and special provisions are taken into consideration when working within a steelhead stream. There are several steelhead streams within Santa Clara County (Table 6).

TABLE 6: Steelhead Streams Within Santa Clara County

Stream Name	Watershed	DPS
Guadalupe River	Guadalupe	CCC Steelhead
Guadalupe Creek	Guadalupe	CCC Steelhead
Alamitos Creek	Guadalupe	CCC Steelhead
Calero Creek / Arroyo Calero	Guadalupe	CCC Steelhead

Stream Name	Watershed	DPS
Los Gatos Creek	Guadalupe	CCC Steelhead
Coyote Creek	Coyote	CCC Steelhead
Upper Penitencia Creek	Coyote	CCC Steelhead
Arroyo Aguague Creek	Coyote	CCC Steelhead
Stevens Creek	Lower Peninsula	CCC Steelhead
San Francisquito Creek	Lower Peninsula	CCC Steelhead
Los Trancos Creek	Lower Peninsula	CCC Steelhead
Pajaro River	Pajaro	SCCC Steelhead
Uvas (Carnadero) Creek	Pajaro	SCCC Steelhead
Solis Creek	Pajaro	SCCC Steelhead
Llagas Creek	Pajaro	SCCC Steelhead
Tar Creek	Pajaro	SCCC Steelhead
Bodfish Creek	Pajaro	SCCC Steelhead
Little Arthur Creek	Pajaro	SCCC Steelhead
Pacheco Creek	Pajaro	SCCC Steelhead
Cedar Creek	Pajaro	SCCC Steelhead
Pescadero Creek	Pajaro	SCCC Steelhead

GREEN STURGEON (*ACIPENSER MEDIROSTRIS*)

Another listed fish species potentially found within Santa Clara County is the green sturgeon (*Acipenser medirostris*). Green sturgeon are listed as Federally Threatened under the Endangered Species Act, but are not a California State listed species. This species was not mentioned in the Fisheries History or the Current Fish Assemblage sections of this document as green sturgeon were not observed during any early fisheries assemblage studies, or observed by District staff within Santa Clara County streams. The green sturgeon life history limits its ability for detection in Santa Clara County streams. Green sturgeon are anadromous, but their southern most spawning population occurs in the Sacramento River (Moyle, 2002). Any fish utilizing Santa Clara County streams would likely be juveniles or adults foraging or rearing before continuing their migration. The lower reaches of stream systems within Santa Clara County and the entire San Francisco Bay estuary were listed as critical habitat for green sturgeon by the National Marine Fisheries Service (NMFS) in 2012 (77 CFR 64959). The potential for occurrence of green sturgeon in waterways of Santa Clara County is low, but there is no physical barrier preventing its distribution into the area.

Like steelhead, the anadromous Green Sturgeon receive additional Federal regulatory consideration under the Magnuson-Stevens Fishery Conservation and Management Act. Freshwater nursery habitat receives the regulatory protections afforded by this set of Federal statutes. Typically the species/habitat is considered generally and the protections and management applied under the Federal Endangered Species Act are in alignment with the Essential Fish Habitat provisions.

LONGFIN SMELT (*SPIRINCHUS THALEICHTHYS*)

The longfin smelt (*Spirinchus thaleichthysI*) is a California State Threatened species and candidate for listing at the Federal level. Much like green sturgeon, longfin smelt was not mentioned in the Fisheries History or the Current Fish Assemblage sections as longfin smelt were not observed during any early fisheries assemblage studies, or observed by District staff

within Santa Clara County streams. Longfin smelt were found in Alviso Slough and mouth of Coyote Creek during South Bay Salt Pond Restoration Project fish sampling in 2012 (Hobbs et al. 2012). Longfin smelt inhabit estuaries and other nearshore habitat, limiting its ability for detection in Santa Clara County streams. Longfin smelt could be found in the lower reaches of Santa Clara County streams, where salinity is greater than two parts per thousand, and may only be found during the spawning season when the fish are looking for lower salinity water. Hobbs et al. (2012) captured longfin smelt in lower Coyote Creek from October through March with peak numbers in December.

Like steelhead and green sturgeon, the longfin smelt receive similar Federal regulatory consideration under the Magnuson-Stevens Fishery Conservation and Management Act. Freshwater nursery habitat receives the regulatory protections afforded by this set of Federal statutes. Typically the species/habitat is considered generally and the protections and management applied under the Federal Endangered Species Act are in alignment with the Essential Fish Habitat provisions.

All work activities and projects in lower reaches of tributary streams of San Francisco Bay conducted by the District must consider the presence of both longfin smelt populations and their habitats. Various seasonal time constraints and special provisions are taken into consideration when working within longfin smelt habitats.

MONTEREY ROACH (*LAVINIA SYMMETRICUS SUBDITUS*) (CALIFORNIA ROACH SUBSPECIES)

Monterey roach is a subspecies of California Roach, found in the Uvas/Llagas watershed. This subspecies currently has no State or Federal protection, but is on the California Department of Fish and Wildlife (CDFW) Watch List. This is a species that has restricted distribution and is under periodic review for population changes. This fish was recorded by Snyder in 1909, but since then has experienced a reduction in distribution (Moyle 2002). The District does not specially manage or monitor for this subspecies.

CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*)

Certain DPS of Chinook salmon have State and Federal protection, but no areas within Santa Clara County are considered critical habitat by NMFS. As mentioned, genetic testing indicates that fish within the Santa Clara County systems are most closely related to Central Valley Fall-run stock (Garcia-Rossi and Hedgecock 2003 and Garza and Pearse, 2008). Presently there is no comprehensive monitoring program or data set that might indicate whether or not this species is naturalizing in our local streams, or whether the population(s) are from an ongoing “subsidy” of hatchery straying. The historical hydrologic conditions of Santa Clara County streams do not favor the life cycle of Chinook salmon in most years, further confirming that these fish are not endemic to these drainages. Regardless, the District has monitored Chinook presence in the Guadalupe and Coyote Watersheds in prior years and takes precautions to not disturb any Chinook within Santa Clara County waterways. Since these fish are presently not listed as a special status species in Santa Clara County, the District places more effort in managing operations for the federally threatened steelhead. Managing the rivers and creeks for steelhead also benefits Chinook salmon by providing suitable habitat and migratory passage.

Like steelhead and green sturgeon, the anadromous Chinook receive similar Federal regulatory consideration under the Magnuson-Stevens Fishery Conservation and Management Act. Freshwater nursery habitat receives the regulatory protections afforded by this set of Federal

statutes. Typically the species/habitat is considered generally and the protections and management applied under the Federal Endangered Species Act for other species act in concert as an “umbrella” of coverage, being in alignment with the Essential Fish Habitat provisions.

V. CONDITIONS IMPACTING NATIVE FISHERIES

In California, the reduction or alternation of fish fauna rarely has a single cause. Often it is difficult to point to a single reason, but rather a combination of changes within the watershed. The causes are often the result of human interference and changes in land use such as: altered hydrology (e.g., water diversions, dams, channel hardening, outfalls), land use, pollution, introduction of non-native species, and drought. An emerging issue impacting native fish is the threat of climate change. These issues will be addressed in the Water Resources Master Plan in order to evaluate and prioritize District actions and watershed specific fisheries enhancements.

5.1 Water Diversions

Most of California's precipitation (i.e., water supply) occurs in the northern half and coastal areas, while the most densely urban areas (i.e., water demands) are the valleys and southern half of the state. The solution has been to build dams, aqueducts and diversions which transport and store water for use. In Santa Clara County, local rainfall and runoff flows into ten reservoirs for storage and blending with imported water. The water is released into creeks and ponds to augment natural percolation and maintain groundwater levels. Some of the local surface water is also processed at drinking water treatment plants.

Dams and diversions affect fish in many ways, but changing the hydrologic regimes within watersheds has inevitable effects on native fish populations. Redistribution of water has acted as conduits to redistribute fish species, both native and non-native.

5.2 Creation of Reservoirs

Reservoirs in California favor lake adapted alien species over the native stream adapted forms. Dams also block migration, both upstream and downstream, for fish which utilize the ocean (i.e., steelhead and lamprey) for any portion of their life history. The streams below dams have altered temperature, flow, and sediment distribution regimes. In Santa Clara County, where reservoirs are used as water supply and flood protection facilities, they provide attenuation of high flows in spring and winter, and a flow of water (when available) in summer to replenish groundwater aquifers and for environmental benefit. Changing the magnitude, duration, frequency, timing and rate of change of water downstream of the reservoir can affect the ecological integrity of the stream, and drastically alter fish populations. Santa Clara County has multiple reservoirs and impoundments, but not all are owned or operated by the District.

5.3 Land Use and Anthropogenic Influences

Many things affect in-stream habitat for native fish and in Santa Clara County, urbanization has complex and profound consequences. Landscape changes associated with urbanization include increased impervious surface area which increases storm water runoff affecting channel hydrology and hydraulics, alteration and maintenance of streams for flood protection (e.g., loss of floodplains, levees, hardscape channels), reduced groundwater recharge, wetland and riparian habitat loss and degradation due to human encroachment. Many stream habitat modifications have unintentional consequences for fish. Some urban modifications include; creation of barriers or passage impediments (i.e., bridges, culverts, pipes, shallow concrete-lined channels), affecting the localized movements of fish, which may be necessary for survival, or removal of large wood to protect stream banks from failing, or increase stream

capacity. These actions reduce habitat complexity and food sources for fish. Santa Clara County has a history of sand and gravel mining in river and creek channels that has impacted channel geomorphology, and created in-channel ponds of warm water supporting non-native predatory fish. Alterations to hydrology and land use contribute to issues associated with species dispersion. Fish passage impediments, primarily an issue for migrating fish, have occurred as a result of land use and alterations to channel hydrology.

Based on District review of the Passage Assessment Database (PAD), maintained by CDFW, 54 total, partial, and natural fish passage barriers (including reservoirs) are present within steelhead streams in Santa Clara County. Temporal barriers were not counted since the degree of impediment is variable. The PAD does not necessarily reflect current conditions and District staff have not yet confirmed the presence of all 54 barriers or their status.

5.4 Pollution

Urban, agricultural, commercial, and domestic runoff/inputs contribute to water pollution within Santa Clara County. The Santa Clara Valley began its modern history as the Valley of Hearts Delight due to its high concentration of orchards, flowering trees, and plants. Until the 1960s, it was the largest fruit production and packaging region in the world. This intensive agricultural use put pressure on the rivers and creeks for both irrigation water supply and sediment deposition as native habitats were converted for agricultural production. The modern era is defined by high density urban land use as Silicon Valley developed into the global capital of the personal computer and internet industries. San Jose is the tenth largest city in the United States by population. The resulting pollution pressures on Santa Clara County's rivers, creeks, fish, and associated native flora and fauna are intense.

Pollution adversely affects fish as it changes the conditions they have adapted to inhabit. Issues associated with dissolved oxygen, pH, and direct ingestion of toxins occur that can potentially lead to immune system suppression, reduced metabolism, and damage to gills and epithelia (Austin 1999). Native fish, particularly *O. mykiss*, may be limited by warm water conditions (Moyle 2002) making thermal warming a type of pollution associated with urban streams. Other types of stressors associated with urban streams are runoff, loss of shade, hardscape channels, in-stream ponding, and trash and debris. Trash rafts and debris jams can limit species movement through the system and reduce the overall success of the species.

5.5 Non-Native Species

Non-native fish were introduced into the Santa Clara Valley through deliberate introduction or by incidental transfer through imported water, vessels, domestic animals and other anthropogenic activities. Most intentional introductions occurred to improve sport fishing and the introduction of non-native bait fish followed. Other potential vectors for the transfer of non-native species include biological control, aquaculture, pet releases, and what is known as "by-product introduction," which is a result of human activity and accidental release (Moyle 2002). Non-native fish impact native fish based upon biological interactions. These interactions include competition, predation, habitat interference, disease, and hybridization. In situations when the interactions are dominated by non-native fish, issues can occur that reduce population size and limit distribution and overall success for native fish and their habitats.

5.6 Drought

Drought is an issue that native fish have adapted to from living in the climate of central California. Prior to reservoirs and controlled flow releases, many streams and rivers within

Santa Clara County experienced dry backs and reduction of habitat (i.e., were naturally intermittent or flowed seasonally) (Grossinger et al. 2006). Through the process of migration and re-colonization during and after droughts, fish abundance and diversity can be maintained.

Severe drought poses significant challenges to the District in maintaining a balance of conjunctive use of water supplies and sustaining healthy fisheries. In normal years, the District is able to supply sufficient water to streams in accordance with operating permits, water rights, and agreements. When sufficient water is not available, the District works with Resource Agencies to make difficult decisions, which may result in temporary reductions in environmental standards and trade-offs between species.

5.7 Climate Change

Temperature and hydrologic effects associated with climate change are likely to exacerbate ecological issues and current degraded conditions within California stream systems. Many of California's native freshwater fish species are already in decline and are particularly vulnerable to climate change, with a high percentage at high risk of extinction. Sensitive species, such as steelhead, are particularly at risk due to specific habitat requirements. Non-native species are more apt to sustain during climate change, as they can tolerate warmer temperatures, and do not have habitat restraints that are seen in California native fish. District policies, programs, projects, and activities incorporate these elements wherever possible, and will continue to consider future adaptability of native species, and the environmental conditions that sustain them. In addition, the District has assembled an internal multi-disciplinary climate change team who are staying abreast of current research and trends in climate change.

VI. FISH PASSAGE IMPROVEMENTS COMPLETED IN SANTA CLARA COUNTY

The District implements, funds, supports, and promotes fisheries enhancements within Santa Clara County. Projects include major stream restorations and improvements to minor sediment removals and large woody debris installations. It has been estimated on designated steelhead streams in Santa Clara County, efforts have been made to improve 45 impediments to fish movement and migration (Table 7) by the District and others. These improvements include installation of fish ladders, channel improvements and retrofits, weirs, and screened diversions.

TABLE 7: Passage Improvements Conducted on Santa Clara County Streams Designated as Steelhead Habitat*

Stream Name	Site Name	Improvement Type
Coyote Watershed		
Coyote Creek	Standish dam	Dam removal
Coyote Creek	Hwy 237 Washington Baffles	Channel Improvement
Coyote Creek	Ford Road Spreader Dams	Dam removal
Coyote Creek	Coyote-Metcalf Steel Dam	Fish Ladder
Upper Penitencia Creek	Mabury step pools/dam	Channel Improvement/ Screened Diversion
Upper Penitencia Creek	Noble Avenue	Fish Ladder
Upper Penitencia Creek	Quail Hollow Low Flow Vehicle Crossing	Channel Improvement
Guadalupe Watershed		
Guadalupe River	Hwy 880 Bridge with Weirs	Weir Retrofit
Guadalupe River	Downstream of Coleman Ave	Weirs
Guadalupe River	Old Julian St. Bridge	Weir
Guadalupe River	St. John Street Weir	Channel Improvement
Guadalupe River	Hwy 280 Concrete and Asphalt Rubble	Channel Improvement
Guadalupe River	Gauging Weir SF23b at Almaden Expressway	Weir Retrofit
Guadalupe River	Hillsdale Road Bridge Crossing	Channel Improvement
Guadalupe River	San Jose low flow crossing	Channel Improvement
Guadalupe River	Alamitos Drop Structure	Fish ladder
Guadalupe Creek	Almaden Expressway to Masson Dam spreader dam removal and restoration	Channel Improvement
Guadalupe Creek	Masson Dam	Fish Ladder
Guadalupe Creek	Gauge 43 Weir along Hicks Road	Weir Retrofit
Guadalupe Creek	U-Frame Concrete Channel-Hicks Rd.	Fish Ladder
Alamitos Creek	Mazzone Drive gabion drop structure	Channel Improvement
San Francisquito Watershed		
San Francisquito Creek	Clarke Avenue Concrete Rubble and Slurry Dam	Channel Improvement
San Francisquito Creek	Bonde Bridge Apron and Concrete Weir (Bonde Weir)	Weir Retrofit

Stream Name	Site Name	Improvement Type
Stevens Watershed		
Stevens Creek	Downstream of Hwy 101 grouted rock step pools	Channel Improvement Steppools
Stevens Creek	Moffet Drop structure	Fish Ladder
Stevens Creek	Gauging Weir (SF35) with Drop Structure at Central Avenue	Weir Retrofit
Stevens Creek	Railroad/Bridge Crossing Evelyn-Central Expwy	Fish Ladder
Stevens Creek	El Camino Real approach ramp	Channel Improvement
Stevens Creek	Fremont Drop Structure and fishway improvements	Fish Ladder
Stevens Creek	Blackberry Farms Low Flow Vehicle Crossings and Diversion	Channel Improvement
Uvas/Llagas Watershed		
Uvas Creek	Railroad/Bridge Crossing—Bolsa Road	Fish Ladder
Llagas Creek	Lower Llagas Flood Control Project (14 Gradient Control Structures)	Fish Ladders
* The District may or may not have been fully engaged in some of the improvements listed. Improvements were included if they occur on streams within the District's purview. The effectiveness of many of these improvements have not been assessed.		

Other fisheries enhancement projects include geomorphic and riparian restoration. These projects include channel modification, bank stabilizations, installation of habitat complexities, riparian plantings and preservation. The Guadalupe Creek Restoration Project focused on increasing riparian shading, but also included bank grading, channel stabilization, and habitat complexities. Other projects include the installation of log grade control structures and vortex weirs, which promote scour and created beneficial rearing habitat, and high flow refugia. Geomorphologic restoration along a reach of Alamitos Creek established riffle and riparian habitat that are critical for native fish. Carnadero Preserve, purchased by the District for SMP mitigation, maintains hundreds of acres of land in agricultural use with buffers adjacent to the streams, restored a large (9 acre) freshwater wetland, and expanded riparian habitat at the confluence of Uvas-Carnadero and Tar Creeks within the Pajaro watershed.

VII. CURRENT DISTRICT FISHERIES ENHANCEMENT EFFORTS

7.1 SAFE, CLEAN WATER AND NATURAL FLOOD PROTECTION PROGRAM (SCW)

In November 2012, the voters of Santa Clara County supported the District's Safe, Clean Water and Natural Flood Protection Program. Developed with input from more than 16,000 residents and stakeholders, this 15-year program was created to match the community's needs and values.

The voters of Santa Clara County clearly recognize the importance of a safe, reliable water supply. They value wildlife habitat, creek restoration and open space. They want to protect our water supply and local dams from the impacts of earthquakes and natural disasters. Within this program, various priorities were developed that relate to protecting and enhancing fisheries in the County. These priorities are indicated with a SCW letter code (A-E) and have numbered projects as a descriptor. Only priorities directly associated with fisheries are included in this section.

SCW D3 Grants and Partnerships to Restore Wildlife Habitat

This project provides grants and partnerships for developing five Stream Corridor Priority Plans to prioritize stream restoration activities including; creating or enhancing wetland, riparian and tidal marsh habitat; protecting special status species; removing fish migration barriers; installing fish ladders; removing non-native, invasive plant species; and planting native species. This project also funds work that provides access to creek side trails or trails that provide a significant link to the creekside trail network.

In Fiscal Year 2014, five grant projects were awarded grants totaling $1,293,531. By 2028, Project D3 will provide six more grant cycles for restoring wildlife habitat and for providing open space access. It will also provide additional partnerships for creating or restoring wetlands, riparian habitat, and favorable stream conditions for fisheries and wildlife.

SCW D4 Fish Habitat and Passage Improvements

This project helps restore and maintain healthy steelhead populations by improving fish passage and habitat. This project in conjunction with others will help meet the new Board Objective 4.1.6 to adopt a strategy to restore the salmonid fishery on identified salmonid streams within fifteen years by creating suitable accessible spawning and rearing habitats. Possible projects associated with SCW D4 include:

- Creek-Lake Separations—To restore stream function and enhance native fish populations in Santa Clara County, the District will complete planning and design of two creek/lake separations and construct one creek/lake separation project in partnership with local agencies.

  Artificial instream impoundments can have negative effects on native fish populations in California because they favor lake-adapted non-native species over native stream adapted species. Impoundments create obstacles for migrating fish (i.e., lack of attractant flow, warm water temperatures, etc.), increase competition for food and habitat resources and foster increased predation with non-native fish species. Instream

impoundments also affect the physical and chemical dynamics of the streams and alter fish assemblages downstream of the impoundment.

- Large Woody Debris and Gravel Augmentation—The District will conduct studies of all major steelhead streams to identify priority locations for installation of large woody debris and gravel and install large woody debris and gravel at a minimum of 5 sites (1 for each of the 5 major watersheds).

  Complex woody debris will be installed in strategic locations to improve stream habitat for native fish populations. Gravel augmentation will also occur in suitable locations to promote benthic macroinvertebrate production and enhance spawning success for native fish. The District plans to ensure the augmentation projects are hydrologically, structurally and biologically suited for the specific physical condition of the site.

- Fish Passage improvements—Fish passage will be improved by removing high priority passage impediments in steelhead streams.

  Urbanized valley floor streams can have a myriad of issues which block migrations or localized movements (i.e., deteriorating culverts, outdated bridges) for steelhead and other native fish. Most native fish in California have tremendous dispersal abilities as both juvenile and adults. Blocking movements within the stream can create many issues such as reduced reproductive success or even death.

The District is working with local partners to select the three priority impediments to be part of this D4 project.

7.2 FISHERIES AND AQUATIC HABITAT COLLABORATIVE EFFORT

The Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Settlement Agreement (Settlement Agreement) was initialed in 2003 by the District, Guadalupe-Coyote Resource Conservation District (GCRCD)—water rights complainants, and resource agencies—CDFW, U. S. Fish and Wildlife Service (USFWS), and NMFS to address the 1996 water rights complaint filed by the GCRCD with the SWRCB. A key Settlement Agreement provision is the Program for the Restoration of Three Creeks[1] that proposes implementation of a fish habitat restoration plan, which includes barrier removal, stream enhancements and reservoir flow releases to support instream flow needs for salmon and steelhead as a means to address the water rights complaint. This effort supports Board's ends policy goal 2.2.1, "manage, operate and maintain raw water transmission and distribution assets to maximize reliability, to minimize life-cycle costs, and to minimize impacts to the environment."

The Fish Habitat Restoration Plan (FHRP) is the umbrella document that describes these FAHCE measures and is the basis for the environmental aspect of the water rights change petition. The FHRP measures will ultimately be incorporated into a State Water Resources

[1] FAHCE Settlement Agreement Article VI: identifies the overall management objective to "restore and maintain healthy steelhead trout and salmon populations as appropriate to each of the Three Creeks, by providing (A) suitable spawning and rearing habitat within each watershed, and (B) adequate passage for adult steelhead trout and salmon to reach suitable spawning and rearing habitat and for out-migration of juveniles."

Control Board-issued water rights order to amend District water rights licenses to address the California Fish and Game Code and resolve the complaint.[2]

The FHRP measures were identified through FAHCE to reduce impacts of water supply operations on anadromous fish, such that:

- Flows in the streams provide sufficient water for Chinook salmon and steelhead species based on seasonal life history requirements.
- Connectivity between key habitat areas in these streams is increased.
- Channel habitat to offset stream impacts is restored.
- A framework for long-term monitoring and management of streams is established.

The FHRP includes long term funding for both specific and programmatic measures:

Flow management—Reservoir Operations

- Flow management measures from improved reservoir releases and upgrades of associated facilities, such as valves and appurtenances to enhance the flexibility of flow management for the benefit of the covered species.

Flow Management—Instream Operations

- Reoperations to support fish passage—i.e., providing bypass flows at instream diversions so that the streams or fish ladders at these facilities have the proper flow levels to allow the passage of fish.
- Facility upgrades for adaptability and flexibility (such as inflatable instream dams).
- Passive screens on all overflows from recharge basins - screens will be designed to preclude passage of juveniles and adults of typical nonnative species in recharge ponds.

Habitat Management

- Channel enhancement to increase the complexity of instream habitat—provide riffle-pool habitat, additional riparian plantings, large organic debris to increase cover for rearing fish and additional gravel to support spawning.
- Barrier removal to eliminate major passage barriers in the Coyote, Guadalupe, and Stevens Creeks and to improve habitat connectivity in the Three Creeks. Table 8 lists the fish passage impediments considered for remediation as part of FAHCE.
- Ongoing management of passage structures to prevent debris and other temporary blockages from adversely affecting passage.

[2] Implementation of the FHRP requires long-term sustainable District funding. For the Water Utility Enterprise to fund these efforts, the proposed conservation measures must have a clear nexus to the purpose of the District Act under the requirements of the groundwater production charges. Incorporation of the FHRP elements into the water rights order provides the nexus between water supply operations, in that the fisheries and habitat improvements are formally identified as a cost of maintaining and operating such facilities.

- Increased maintenance of fish ladders and stream gauges, and the draining and cleaning of recharge ponds located in the Three Creeks.

TABLE 8: Barriers considered for remediation by FAHCE District Programs.

Stream Name	Site	Ownership	Description	District Role
Coyote Creek	Singleton Road	City of San Jose	Removal of fish passage barrier	Partial Funding
Guadalupe Creek	Old Dam	Others	Removal of fish passage barrier	Partial Funding
Alamitos Creek	Drop Structure	Others	Removal of fish passage barrier	Partial Funding
Alamitos Creek	Almaden Lake	City of San Jose	Lake/Creek Separation	Lead
Pheasant Creek	Culvert at Confluence	Others	Removal of Fish Passage Barrier	Partial Funding
Stevens Creek	Evelyn Drop Structure	Others	Maintain Ladder	Lead
Stevens Creek	Fremont Drop Structure	District	Maintain Ladder	Lead
Stevens Creek	Moffett Boulevard Drop Structure	District	Replace/refurbish Ladder	Lead

7.3 GUADALUPE RIVER PROJECT MITIGATION MONITORING PROGRAM

Fisheries monitoring is part of the mitigation and monitoring program (MMP) for two flood control projects on the Guadalupe River. The two flood control projects extend along the Guadalupe River from South San Francisco Bay salt pond A8 just downstream of the Union Pacific Railroad Bridge in Alviso to Grant Street just upstream of I-280 in San Jose. In addition, Guadalupe Creek from Almaden Expressway to Masson Dam was restored as mitigation for downstream project impacts and its success is monitored as part of this program.

The Guadalupe River mitigation monitoring program is based on adaptive management and has been ongoing since 2001. Adaptive management involves selection of indicators and measurable objectives during the planning process, measurement of indicators as part of the monitoring phase, and assessment to determine achievement of mitigation objectives during the agency review phase. All 3 phases are ongoing until the mitigation objectives are achieved. An Adaptive Management Team (AMT) directs and implements the adaptive management process. The AMT consists of representatives with technical expertise from the District, USACE, City of San Jose, SWRCB, RWQCB, USFWS, NMFS, CDFW, Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited. The AMT may amend the MMP, if necessary, on the basis of the monitoring results and through a consensus process subject to necessary regulatory approvals. The AMT have been meeting at least annually for the past 15 years to vigorously review monitoring results and

drive changes to the program. Subcommittees and science panels of technical experts have been formed to address challenging issues and environmental conditions for the AMT over the years.

To mitigate adverse effects on anadromous fish and riparian habitat from the projects, the MMP includes components related to riparian vegetation, Shaded Riverine Aquatic (SRA) cover, spawning gravels, anadromous fish passage, and water temperature. This monitoring evaluates the physical habitat characteristics of the Guadalupe River and Guadalupe Creek as they relate to fish. Monitoring is focused on evaluating physical habitat characteristics for beneficial use of *O. mykiss* for rearing, reproduction, and migration. These parameters are measured and compared to a set of measurable objectives on an annual basis.

The MMP also includes an *O. mykiss* population monitoring component, achieved through juvenile rearing studies. Through this study, overall fisheries assemblage data within the Guadalupe watershed is available. As of 2014, the data demonstrates that the Guadalupe watershed continues to support juvenile rearing *O. mykiss*.

7.4 UPPER GUADALUPE RIVER PROJECT

The Upper Guadalupe River Project (UGRP) is proposed for construction by the Corps and District along 6.4 miles of the Guadalupe River between Interstate 280 to Blossom Hill Road. It continues upstream (south) from the Guadalupe River project presented above. The UGRP also includes construction on 0.3 miles of Canoas Creek between the Guadalupe River and the end of Nightingale Avenue; 1.0 mile of Ross Creek between the Guadalupe River and Jarvis Avenue; and removal of fish barriers upstream. The UGRP consists of channel modifications and maintenance along 7 reaches of the Guadalupe River. Each reach will be modified or a flood bypass constructed adjacent to the active channel to contain the computed 100-year frequency flood event and prevent flood damages to surrounding neighborhoods.

This project is still in the implementation phase with construction completed at Reaches 6 and 10B in 2012 and work at the most upstream Reach 12 in 2015. Like the downtown and lower Guadalupe River projects noted above, the UGRP involves an adaptive management process through the Guadalupe Watershed Integrated Working Group (GWIWG) and AMT. Various feasibility studies and recommendations for improving fisheries habitat have been made to mitigate for the project. The USACE, District, and GWIWG developed a Gravel Augmentation Plan to investigate the possibility of adding gravel at UGRP reaches to: (1) prevent the loss of and increase salmonid habitat; and (2) promote channel stability. This study is being used to develop District funded gravel augmentations within the project. Other habitat improvements will include riparian restoration and addition of in-stream habitat complexities.

7.5 INTEGRATED WATER RESOURCES MASTER PLAN

The District-initiated *Integrated Water Resources Master Plan* is being developed to create a long term plan for management of Santa Clara County water resources based on scientific rigor, integrated watershed-scale considerations, and stakeholder engagement. The Master Plan will integrate and incorporate the three components of the District mission including water supply, flood protection, and watershed stewardship. In so doing, the Master Plan will focus on various planning elements including water supply, flood protection, water quality, open space, trails and recreation, climate change, bayfront areas, and ecological elements including wildlife, vegetation, and fisheries.

VIII. DISTRICT STEWARDSHIP AND CONSERVATION EFFORTS WITH ANCILLARY BENEFIT TO FISHERIES

All of the programs in this section have a benefit to fish, though it may not be their primary goal. Several of the SCW programs, the South Bay Salt Pond Restoration Project and Asset Management contribute to watershed health and promote conditions that favor native fisheries. Other programs such as the Stream Maintenance Program are focused on county wide flood protection and water conveyance, but require fisheries enhancements for mitigation.

8.1 SAFE, CLEAN WATER AND NATURAL FLOOD PROTECTION PROGRAM (SCW)

SCW B1 Impaired Water Body Improvement

The District is required to manage mercury in the Guadalupe River Watershed, with the purpose to reduce methyl mercury concentrations in fish to levels that are not harmful for consumption by wildlife and humans. The management activities include reducing mercury loading to the bay and treating impoundments to reduce bioaccumulation of methyl mercury in the food web.

Mercury removal from the Guadalupe River Watershed is accomplished by the District in the following ways:

- Removal of visible eroding mine waste
- Removal of sediment for flood facility maintenance
- Removal from restoration and flood facility construction (Capital projects)
- Removal from percolation pond maintenance

Since 2000, the District has tracked the amount of mercury removed from the Guadalupe River Watershed in order to claim “credit” for activities proscribed in the Guadalupe River Watershed TMDL intended to reduce the load of mercury to San Francisco Bay. These activities permanently remove mercury from the watershed and ultimately prevent its discharge to the bay. By reducing mercury discharged to the bay, mercury in fish in the bay will eventually decline to concentrations that are not harmful for consumption by wildlife and humans. Mercury concentrations in fish within the watershed may also decline due to these activities, particularly in the percolation ponds.

From 2000-2009, 392 kg of mercury were removed from 11 sites on Alamitos Creek where visible deposits of eroding mine waste were located on District-owned property. Sediment removal activities associated with flood control maintenance activities from 2001-2013 extracted an additional 137 kg of mercury. Mercury removal associated with Capital projects included: 2000 Guadalupe Creek Restoration Project (422 kg), 2002 Lower Guadalupe Flood Control

Project (543 kg), and the 2009 Jacques Gulch Restoration Project (816 kg). In 2014, rehabilitation of the percolation ponds on Los Alamitos Creek, Guadalupe Creek, and Guadalupe River removed 582 kg of mercury.

In sum, nearly 2900 kg of mercury has been removed from the Guadalupe River Watershed by the District from 2000-2014.

Treatment of impoundments to reduce bioaccumulation of methyl mercury in the food web is currently being explored using oxygenation systems. Methylated forms of mercury that are

produced in anaerobic conditions are more bioavailable for uptake into the food chain. Oxygenation of the impoundments is hypothesized to prevent the conditions which cause methyl mercury to be produced from the bottom sediments. Suppression of methyl mercury production should reduce the amount of methyl mercury that is bioavailable, and eventually result in lower concentrations of methyl mercury in fish. Side benefits include improved water quality in the discharges from the impoundments, and improved habitat within the impoundments. Oxygenation systems are currently installed in Calero reservoir, Guadalupe reservoir, Almaden Lake, Almaden Reservoir and Stevens Creek Reservoir.

SCW B2 Interagency Urban Runoff Program

SCVURPPP and the District's Interagency Urban Runoff Program have completed several studies related to fisheries and fish habitat. These studies include both biological and physical monitoring conducted on various Santa Clara County streams.

SCVURPPP annually conducts benthic macroinvertebrate (BMI) assemblage evaluations on various creeks in Santa Clara County. Through this study it was determined that the upper watersheds show a comparatively diverse assemblage of BMI species, while the lower watersheds tend to lack diversity due to water quality issues and flow conditions that limit taxa which can colonize in those areas.

Associated with the BMI studies, a steelhead limiting factors analysis has been conducted by SCVURPP on both Stevens and Upper Penitencia Creeks. Results of these studies indicated that a lack of over wintering habitat and high degrees of gravel embeddedness were the limiting factors prohibiting steelhead from thriving in these streams. Gravel augmentation and distribution was indicated as a likely helpful action to improve both over wintering habitat and improve spawning gravel availability.

SCVURPPP has developed a monitoring plan to better understand the water quality of the streams within Santa Clara County. This plan includes focused studies on Dissolved Oxygen (DO) levels during first flush events (first significant rain event of the season) to aid in investigations of reported fish kills. These studies documented the fluctuation of DO before and after the rain event using unattended water quality devices. It was determined that reductions in DO after storm events could be attributed to the high post rain biological oxygen demand from various pollutants and mobile vegetation in the streams. A solution to this situation has not yet been developed. Other parameters such as pH, conductivity, temperature, and chlorophyll levels have been monitored to help better understand water quality and the associated issues during these first flush events.

Other point source pollutants have been evaluated within specific areas within Santa Clara County through stream toxicity monitoring. This has helped increase public information and has been successful in reducing the amount of pesticides and herbicide applications in targeted areas.

SCW B3 Pollution Prevention Partnership Grants

This project provides pollution prevention grants to qualified local agencies, nonprofit groups, schools, and municipalities for specific programs to reduce contaminants in surface or groundwater, and reduce emerging contaminants. Project benefits include helping to prevent contaminants such as pharmaceuticals, household hazardous waste and trash from entering our waterways by:

- Helping to meet regulatory requirements as listed under the impaired water bodies listing of the federal Clean Water Act;

- Reducing contaminant source loads in groundwater and surface water, and protects local watersheds;

- Providing public education to reduce contaminants in our waterways; and

- Leveraging community resources for efficient use of funds.

In Fiscal Year 2014, three projects were awarded grants totaling $433,200. There will be six more grant cycles and 3 partnerships to be established by 2028.

SCW B4 Good Neighbor Program: Homeless Encampment Cleanup

This project supports fisheries habitat enhancement by reducing trash, debris and pollutants from entering the streams. The program elements include ongoing coordination with local cities and agencies to clean up large creek-side homeless encampments that contaminate waterways and damage District facilities and the habitat. This District is committed to a minimum of 52 clean ups a year and District efforts have already surpassed this number. By reducing anthropogenic inputs to the stream and reducing impact to the riparian corridor, quality fisheries habitat can be maintained.

SCW B7 Support Volunteer Cleanup Efforts and Education

This project provides grants and partnerships for cleanup, education, outreach and watershed stewardship activities. Funding also allows the District to continue supporting volunteer cleanup activities such as National River Cleanup Day, California Coastal Cleanup Day, the Great American Pick Up, and Adopt-A-Creek, as well as Creek Connections Action Group and creekwise education. Benefits of Project B7 include:

- Reducing contaminants entering our waterways and groundwater;
- Engaging community, and supports watershed stewardship; and
- Leveraging volunteer community resources for efficient use of funds.

In Fiscal Year 2014, seven projects were awarded grants totaling $354,390. There will be six more grant cycles and 3 partnerships to be established by 2028.

SCW D5 Ecological Data Collection and Analysis

The Ecological Data Collection and Analysis project has multiple aspects related to fisheries. It is a watershed approach to ecosystem management. Rivers and creeks along with their associated riparian and wetland habitats are evaluated for overall condition, functional capacity, and health. Environmental databases are being developed that consolidate data on County or District-wide environmental conditions, and to support publically available databases (e.g., EcoAtlas, CEDEN, California Water Quality Monitoring Council). The project establishes ecological assets in cooperation with the District-wide Asset Management Program, such as fish passage facilities and high value habitats in order to maintain their functional capacity. Habitat conservation and restoration is guided by quantitative and standardized assessments using state-of-the-science approaches that are consistent with the resource agencies.

By implementing the SCW D5 project, the District is getting ahead of the curve with the permitting agencies. The USACE and the RWQCB recommend a watershed approach and functional assessments, such as the California Rapid Assessment Method (CRAM) that is applied by the SCW D5 project, for Clean Water Act and Porter-Cologne Water Quality Control Act permits.

Creating a comprehensive watershed database to track ecosystem condition is rapidly evolving through the Surface Water Ambient Monitoring Program (SWAMP). The District is a SWAMP partner and participant through SCVURPPP. Watershed assessments using CRAM and SWAMP are effective ways for the District to work with other agencies and organizations to make informed decisions, especially as they relate to the County's creeks and rivers, as well as San Francisco Bay, Monterey Bay, regional and statewide scales.

SCW D6 Creek Restoration and Stabilization

The SCW D6 project provides funding for design and construction of projects that increase the stability of eroding creek banks and help restore the natural functions of stream channels using geomorphic data and principles. This program will use scientific principles to restore sediment balance and reduce erosion, instability and sedimentation in creeks. At least three geomorphic projects will be designed and built under this project, all of which will benefit native fish and their life histories.

SCW D7 Partnerships for the Conservation of Habitat Lands

The Santa Clara Valley Habitat Conservation Plan (Plan) is the basis for a 50-year permit under the federal ESA and state NCCP. The Plan has six co-permittees including the District and is expected to be implemented to protect 18 threatened, endangered or sensitive species found within Santa Clara County by creating a network of habitat reserves for these species. Protected species include nine animals and nine plants: California tiger salamander, California red–legged frog, least bell's vireo, bay checkerspot butterfly, San Joaquin kit fox, tri-colored blackbird, western burrowing owl, California yellow-legged frog, western pond turtle, and nine endemic serpentine plant species. Under the plan, over 46,000 acres of land will be managed as part of the reserve system including restoration and enhancement of 500 acres of habitat and 10 miles of streams. This program will allow for a coordinated regional mitigation approach enabling protection, enhancement and restoration of natural resources within the County, and contributing to the recovery of various special status species.

8.2 STREAM MAINTENANCE PROGRAM

The Districts Stream Maintenance Program (SMP) works to balance the protection and restoration of sensitive fish and aquatic resources with a reliable water conveyance system throughout Santa Clara County. The SMP works to mitigate any maintenance activities that could potentially cause impacts to aquatic resources through a list of best management practices (BMP) and mitigation requirements. These BMPs and mitigation activities are based upon discussions and recommendations from State and Federal Resource Agencies.

To minimize impacts to salmonids, the SMP program has an established work window that avoids both the juvenile outmigration and adult escapement periods. Specific work can be conducted outside of the designated work window with approval of the Resource Agencies. Any in-stream work which results in a dry back or other adverse aquatic conditions requires a fish relocation. These relocations consist of capturing and transferring all aquatic resources from the area to be impacted, to an area of comparable habitat. These actions help maintain the

biota in the streams and allow for work to be completed with reduced impacts to aquatic resources.

The SMP requires mitigation for sediment removals in steelhead creeks. If coarse sediments are removed from the channel in the interest of water conveyance or stream capacity, similar material is reintroduced into the system. This gravel augmentation work under the SMP, accounts for several factors including: the existing channel conditions; the grain size distribution of the sediment to be added; the volume of gravel to deposit; the frequency of gravel addition that will be required in light of sediment transport; how the added gravel will interact with the existing flow regime and/or channel geometry; and the extent of augmentation effects within the channel reach.

The SMP also manages and implements a large woody debris (LWD) program to help maintain the physical and biological processes associated with the natural recruitment of wood to waterways. The LWD evaluation and implementation program includes an assessment of the ecological, geomorphic and hydraulic effects (creek, canal and stream gauge functions) of LWD in the creeks of Santa Clara County. The evaluation and implementation program achieves flood protection objectives while considering the ecological integrity of local streams.

8.3 SOUTH BAY SALT POND RESTORATION PROJECT

The South Bay Salt Pond Restoration Project (SBSP), is the largest tidal wetland restoration project on the West Coast. The District is part of the Executive Leadership Group along with the USFWS, CDFW, State Coastal Commission, and Alameda Flood Control District. The District is also on the Project Management Team with the resource agencies above plus the National Oceanic and Atmospheric Administration (NOAA), and USACE. In 2006, the District directly partnered with the USFWS and the SBSP to breach the first set of ponds in the South Bay, Ponds A19, A20, and A21 also known as the Island Ponds in the Alviso Pond complex. This project provides tidal wetland and Ridgeway rail (formerly known as the California clapper rail) mitigation for two District programs and has resulted in the restoration of over 475 acres of tidal marsh habitat which is utilized by a variety of wildlife and fish including, the Federally listed Ridgeway rail and the State listed longfin smelt.

Another important component of the SBSP is to improve the water quality in Pond A8 to enable further tidal marsh restoration in the area. The District constructed a set of eight adjustable tide gates to allow tidal flows to enter and exit Pond A8 in a controlled manner so the impact of mercury-laden sediments on fish and wildlife could be more easily assessed. To study the effects of steelhead entrainment in the Pond, the District partnered with the SBSP to track steelhead movement in the Guadalupe River. Since 2014, the tide gates have been left open year-round while the movement of tagged fish continues to be studied. If this study continues to show positive results, the tidal gates could permanently remain open year-round. The USFWS owns and operates the tide gates on Pond A8, and manages south bay salt pond water levels.

8.4 DISTRICT-WIDE ASSET MANAGEMENT PROGRAM

As an effort to manage its assets, the District implements a comprehensive asset management program to optimize infrastructure investment strategies, and enhance related financial planning. The District has made substantial public investments in assets that provide water supply, flood protection, and environmental stewardship for residents and businesses in Silicon Valley. The District must manage these assets in a manner that makes the best use of public resources in order to sustain these services indefinitely into the future. In the short term, the District's Asset Management Program seeks to reduce unplanned asset failures or service outages, and the economic, social, or environmental consequences of these failures. For the

long-term, the program seeks to minimize operating and capital costs of owning these assets, and enable accurate financial planning.

The District-wide Asset Management Program is being expanded to include ecological assets such as groundwater aquifers, creeks, rivers, reservoirs, mitigation sites, fish structures and habitat features such as many of those listed in Table 8, and key habitats. Creek and river channel conditions at reach and site scales including wetland and riparian habitats will also be included as ecological assets. In coordination with SCW D5, ecological assets are inventoried, condition or health measured, and management levels of service established. Levels of service are management goals intended to preserve, restore, and enhance environmental conditions. The Asset Management Program provides an inventory, current conditions, expected level of service, inspection criteria and schedule, and related calculations of an ecological assets value, consequence of failure, and prioritization for management action. The ecological asset registry will help show where high value habitats exist, including for fisheries (e.g., spawning and food production riffles, native riparian forest), as well as habitats with low functional values where mitigation, enhancement, and stewardship actions could be initiated.

REFERENCES

Austin, B. 1998. *The Effects of Pollution on Fish Health*, *Journal of Applied Microbiology*, 85(1): 234-242.

Aceituno, M. E., Caywood, M. L., Nicola, S. J., and Follett, W. I. 1976. *Occurrence of Native Fishes in Alameda and Coyote Creeks*, California, California Department of Fish and Game Journal, 62: 195-206.

Garcia-Rossi D, Hedgecock D (2002) *Provenance Analysis of Chinook Salmon (Oncorhynchus tshawytscha) in the Santa Clara Valley Watershed*. Report to the Santa Clara Valley Water District.

Garza, J. C. and D. Pearse. 2008. *"Population Genetics of Oncorhynchus Mykiss in the Santa Clara Valley Region"*. Final Report for the Santa Clara Valley Water District, San Jose, CA.

Grossinger, R., R. Askevold, C. J. Striplen, E. Brewster, S. Pearce, K. Larned, L. J. McKee, and J. N. Collins. 2006. *Coyote Creek Watershed Historical Ecology Study: Historical Condition, Landscape Change, and Restoration Potential in the Eastern Santa Clara Valley, California*. Contribution No. 426, Prepared by the San Francisco Estuary Institute, Oakland, CA. Prepared for the Santa Clara Valley Water District, San Jose, CA. Available at: http://www.sfei.org/node/1559

Habitat Restoration Group (HRG) 1995. *Mid-Coyote Creek Baseline Assessment. Montague Expressway to E. Santa Clara Street.* Prepared for the Santa Clara Valley Water District via Parsons Engineering-Science.

Hobbs, James A., Peter Moyle, and Nicholas Buckmaster. 2012. *Monitoring the Response of Fish Communities to Salt Pond Restoration: Final Report*. Prepared by Dr. James A. Hobbs (Principal Investigator and Sentinel Species Health Lead Author), Dr. Peter Moyle (Co-Investigator), Nicholas Buckmaster (Fish Community Study Lead Author). Prepared for South Bay Salt Pond Restoration Program & Resource Legacy Fund. Reagents of the University of California, Davis, CA.

Hubbs, C. L. 1925. *The Life-Cycle and Growth of Lampreys, Papers of the Michigan Academy of Sciences, Arts and Letters* 1: 587-603.

Mitsch, William J., and James G. Gosselink. 2007. *Wetlands*. 4th ed., John Wiley & Sons, Inc. Hoboken, NJ.

Moyle, P. B. 2002. *Inland Fishes of California. Berkeley: University of California Press*, 1-502.

Moyle, P. B., Israel, J. A., Purdy, S. E. 2008. *Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna*. Center for Watershed Sciences, University California Davis, Davis, CA.

National Oceanic and Atmospheric Administration (NOAA) Fisheries (NMFS). 2012. Federal Register, 77(206). Available at: https://www.federalregister.gov/articles/2012/10/24/2012-26237/endangered-and-threatened-species-initiation-of-5-year-review-for-the-southern-distinct-population

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). 2001. *Stormwater Environmental Indicators Demonstration Project- Final Report*. Prepared for Water Environment Research Foundation, Project 96-IRM-3, USEPA Cooperative Agreement #CX 823666-01-2.

Shapovalov, L., and A. C. Taft. 1954. *The life histories of the steelhead Rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Waddell Creek, California, and recommendations regarding their management.* DFG Bulletin No. 98.

Smith, J. J. 1982. *Fishes of the Pajaro River System, in: Studies on the distribution and ecology of stream fishes of the Sacramento-San Joaquin drainage system, CA.* P. B. Moyle (ed), University of California Publications in Zoology 115: 83-169.

Snyder, J. O. 1904. *Notes on the Fishes of the Streams Flowing into San Francisco Bay, California, Report to the Bureau of Fisheries, 1: 327-339*.

Snyder, J. O. 1913. *The fishes of the streams tributary to Monterey Bay, California*. Bull. U. S. Bur. Fish. 32:49–72.

South Bay Salt Pond Restoration Project (SBSP). 2007. Biological Resources, Section 3.6 of the Final Environmental Impact Statement / Report. Available at: http://www.southbayrestoration.org/pdf_files/SBSP_EIR_Final/3.6%20Biological%20Resources%20Final%20EIS_R.pdf

Williams, T. H., Spence, B. C., Lindley, S. T., and Boughton, D. A. (2010) *North-Central California Coast Recovery Domain 5-Year Review: Summary and Evaluation of Central California Coastal Steelhead DPS Northern California Steelhead DPS*. National Marine Fisheries Service, Southwest Fisheries Science Center, 110 Shaffer Road, Santa Cruz, CA 94929.